CUTTING TOOL ASSEMBLY

FIELD OF THE INVENTION

The present invention relates to a cutting tool assembly having an indexable cutting insert and more particularly to a cutting tool assembly for grooving operations in which the cutting insert is mechanically clamped.

BACKGROUND OF THE INVENTION

In such cutting tool assemblies the cutting insert is retained in an insert pocket defined between clamping surfaces of upper and lower jaws of the insert holder, generally referred to as clamping and base jaws, respectively. The insert holder can be a one-piece tool, or, the clamping jaw can be a separate member. In both cases, at least one screw is used for forcing the two jaws towards each other for secure retention of the cutting insert.

In order to uniquely determine the axial location of the cutting insert an axial stop is provided in the insert pocket. In some prior art cutting tool assemblies the stop is located on one of the clamping surfaces of the upper and lower clamping jaws. In such cases, the cutting insert has to be designed with an appropriate protrusion or recess, on the corresponding insert clamping abutment surface, for engaging the stop. In other prior art cutting tool assemblies, the stop is located at the rear of the insert pocket and the axial location of the cutting insert is fixed when

a section of the rear surface of the cutting insert abuts the stop. This arrangement has two disadvantages. First, it restricts the shape of the rear surface of the cutting insert. For double-ended grooving cutting inserts the rear surface is the non-operative front relief surface. Hence, this arrangement restricts the shape of the front relief surface of the cutting insert. Second, if the end portion of the cutting insert, associated with the operative cutting edge, were to break during a cutting operation, the section of the relief surface which would abut the stop on indexing the cutting insert, may well become damaged, in which case the cutting insert could not be indexed, preventing use of the cutting edge associated with the non-damaged end portion of the cutting insert.

To stabilize the cutting insert in the direction perpendicular to the axial direction, the clamping abutment surfaces of the cutting insert are formed with V-shaped protrusions (or grooves) and the clamping surfaces of the insert holder's jaws are formed with matching V-shaped grooves (or protrusions). According to some embodiments of such cutting tool assemblies, the cutting inserts have a stop-engaging protrusion (or recess) on one of their clamping abutment surfaces and the insert holders having a corresponding stop-engaging recess (or protrusion) on one of the clamping surfaces of one of their clamping jaws. The presence of such stop-engaging protrusions (or recesses) can be disadvantageous.

It is an object of the present invention to provide a double-ended grooving cutting insert that substantially overcomes the above mentioned disadvantages.

It is also an object of the present invention to provide an insert holder for retaining the above-mentioned grooving cutting insert.

SUMMARY OF THE INVENTION

In accordance with the present invention there is provided a cutting insert comprising a central body portion extending between two opposite end portions, each end portion being provided with a cutting edge; the central body

portion being provided with upper and lower clamping abutment surfaces with first and second side surfaces extending therebetween; at least one of the first and second side surfaces being provided with an axial location member.

In accordance with one embodiment, the axial location member is a protrusion.

Generally, the protrusion is square shaped.

In accordance with another embodiment of the present invention, the axial location member is a recess.

Preferably, the upper and lower clamping abutment surfaces are sloped, defining therebetween a variable distance, so that when the cutting insert is viewed in an end view the distance between the upper and lower clamping abutment surfaces is a maximum at the first side surface and a minimum at the second side surface.

If desired, the upper and lower clamping abutment surfaces have the form of V-shaped protrusions.

Further if desired, the upper and lower clamping abutment surfaces have the form of V-shaped grooves.

There is also provided in accordance with the present invention a cutting tool assembly comprising:

a cutting insert holder; and

a cutting insert;

the cutting insert holder comprising:

an upper clamping jaw having an upper clamping surface;

a lower base jaw having a lower clamping surface;

at least one clamping screw passing through the upper clamping jaw and threadingly connected to the lower base jaw;

an insert holder inner side surface extending between the upper and lower clamping surfaces;

an insert pocket bound on two opposite sides by the upper and lower

clamping surfaces and bound on a third side extending between the two opposite sides by the insert holder inner side surface; the insert holder inner side surface being provided with a positioning member;

the cutting insert comprising:

a central body portion extending between two opposite end portions, each end portion being provided with a cutting edge; the central body portion being provided with upper and lower clamping abutment surfaces with first and second side surfaces extending therebetween; at least one of the first and second side surfaces being provided with an axial location member;

wherein the upper clamping abutment surface abuts the upper clamping surface, the lower clamping abutment surface abuts the lower clamping surface and the positioning member engages the axial location member whereby the axial location of the cutting insert is fixed.

In accordance with one embodiment, the axial location member is a protrusion and the positioning member is a rear surface of a recess in the insert holder inner side surface.

Generally, the protrusion is square shaped and the recess has a generally matching square shaped cross section.

In accordance with another embodiment, the axial location member is a recess and the positioning member is a protrusion on the insert holder inner side surface.

Preferably, the upper and lower clamping abutment surfaces are sloped, defining therebetween a variable distance, so that when the cutting insert is viewed in an end view the distance between the upper and lower clamping abutment surfaces is a maximum at the first side surface and a minimum at the second side surface and the upper and lower clamping surfaces of the upper clamping jaw and the lower base jaw, respectively, are matchingly sloped.

If desired, the upper and lower clamping abutment surfaces have the form of V-shaped protrusions and the upper and lower clamping surfaces of the

upper clamping jaw and the lower base jaw, respectively, have the form of matching V-shaped grooves.

Further if desired, the upper and lower clamping abutment surfaces have the form of V-shaped grooves and the upper and lower clamping surfaces of the upper clamping jaw and the lower base jaw, respectively, have the form of matching V-shaped protrusions.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Fig. 1 is a right perspective view of a cutting tool assembly in accordance with one preferred embodiment of the present invention with the cutting insert removed from the insert holder;

Fig. 2 is a left perspective view of the cutting tool assembly shown in Fig. 1;

Fig. 3a is a side view of the cutting insert shown in Figs. 1 and 2;

Fig. 3b is a top view of the cutting insert shown in Figs. 1 and 2;

Fig. 3c is a front view of the cutting insert shown in Figs. 1 and 2;

Fig. 4a is a partial side view of the insert holder shown in Figs. 1 and 2;

Fig. 4b is a cross-sectional view along line IVb-IVb in Fig. 4a;

Fig. 4c is a partial front view of the insert holder shown in Figs. 1 and 2;

Fig. 5 is a right perspective view of a cutting tool assembly in accordance with another preferred embodiment of the present invention with the cutting insert removed from the insert holder;

Fig. 6a is left perspective view of the cutting insert shown in Fig. 5;

Fig. 6b is a side view of the cutting insert shown in Figs. 5 and 6a;

Fig. 7 is a side view of a cutting tool assembly in accordance with the present invention with the cutting insert removed from the insert holder, the clamping abutment surfaces of the cutting insert are sloped and the clamping surfaces of the insert holder's jaws are formed with matching slopes;

Fig. 8 is a side view of a cutting tool assembly in accordance with the present invention with the cutting insert removed from the insert holder, the clamping abutment surfaces of the cutting insert are formed with V-shaped protrusions and the clamping surfaces of the insert holder's jaws are formed with matching V-shaped grooves;

Fig. 9 is a side view of a cutting tool assembly in accordance with the present invention with the cutting insert removed from the insert holder, the clamping abutment surfaces of the cutting insert are formed with V-shaped grooves and the clamping surfaces of the insert holder's jaws are formed with matching V-shaped or protrusions;

Fig. 10a is a front view of a cutting insert having a protrusion on each of the side surfaces of the central body portion;

Fig. 10b is a side view of the cutting insert shown in Fig. 10a;

Fig. 11a is a front view of a cutting insert having a recess in each of the side surfaces of the central body portion; and

Fig. 11b is a side view of the cutting insert shown in Fig. 11a.

DETAILED DESCRIPTION OF THE INVENTION

Attention is first drawn to Figs. 1 to 4c, showing a cutting tool assembly **20** in accordance with the present invention comprising a cutting insert holder **22** and a cutting insert **24**. The cutting insert holder **22** comprises an upper clamping jaw **26** having an upper clamping surface **28** and a lower base jaw **30** having a lower clamping surface **32**. Two clamping screws **34** are used to securely clamp the cutting insert **24** between the upper and lower clamping surfaces. Each clamping screw **34** passes through a through bore **36** in the upper clamping jaw **26** and is threadingly connected to the lower clamping jaw via a threaded bore **38** in the lower base jaw **30**. Between the upper and lower clamping surfaces extends an insert holder inner side surface **40**. An insert pocket **42**, for receiving and retaining the cutting insert **24**, is bound on two opposite sides by the upper and lower

clamping surfaces and on a third side, extending between the two opposite sides, by the insert holder inner side surface **40**. The insert holder inner side surface is provided with a recess **44** having a rear surface **45** forming a positioning member for the determination of the axial location of the cutting insert.

The cutting insert **24** comprises a central body portion **46** extending between two opposite end portions **48**, **50**, the end portions being provided with cutting edges **52**. The central body portion **46** has upper and lower clamping abutment surfaces **54**, **56** with first and second side surfaces **58**, **60**, extending therebetween. The first side surface **58** is provided with a protrusion **62** forming an axial location member for the cutting insert. The protrusion **62**, in the embodiment shown, is square shaped and the recess **44** has a matching square shaped cross section for receiving the protrusion **62**.

When the cutting tool assembly is assembled, the upper clamping abutment surface **54** of the cutting insert **24** abuts the upper clamping surface **28** of the upper clamping jaw **26**, the lower clamping abutment surface **56** of the cutting insert abuts the lower clamping surface **32** of the base jaw **30** and the protrusion **62** engages the rear surface **45** of the recess **44**, whereby the axial location of the cutting insert **24** is fixed.

It should be noted that the cutting insert **24** has 180° rotational symmetry about an axis perpendicular to a longitudinal plane **P** of the cutting insert and passing through the center of the protrusion **62**. Hence, for a given orientation of the cutting insert, as best seen in Fig. 3a, one of the cutting edges **52** is an upper cutting edge, associated with the upper clamping abutment surface **54**, whilst the other cutting edge **52** is a lower cutting edge, associated with the lower clamping abutment surface **56**. Clearly, as best seen in Figs. 1 and 2, the upper cutting edge is the operative cutting edge. It should further be noted that since the present invention is directed to the axial location of the cutting insert and not to its specific shape or function, the cutting edges and the associated rake and relief surfaces are only shown schematically and it will be apparent that any

required form of rake and relief surface and associated cutting edge can be used.

Attention is now drawn to Figs. 5 to 6b showing a cutting insert holder **64** and an associated cutting insert **66** in accordance with another embodiment of the present invention. In this embodiment the axial location of the cutting insert **66** is determined by the engagement of a protrusion **68** on the insert holder inner side surface **40** by a recess **70** in the first side surface **58** of the central body portion **46** of the cutting insert. As shown in Figs. 5 to 6b, there are two recesses **70** on the first side surface **58** of the central body portion **46**. Therefore, as with the above described first embodiment, the cutting insert has 180° rotational symmetry about an axis passing through the geometrical center of the side surfaces **58**, **60** of the central body portion **46** and perpendicular to a longitudinal plane of the cutting insert **66**. Hence, for a given orientation of the cutting insert, as best seen in Fig. 6b (which is similar to Fig. 3a), one of the cutting edges **52** is an upper cutting edge, associated with the upper clamping abutment surface **54**, whilst the other cutting edge **52** is a lower cutting edge, associated with the lower clamping abutment surface **56**.

In the embodiments shown in Figs. 1 to 6b, the geometry of the upper and lower clamping abutment surfaces **54**, **56** is not detailed and these surfaces are shown schematically to be flat and parallel. Figs. 7 to 9 show different possible geometries for the upper and lower clamping abutment surfaces. Although these geometries are exemplified for the embodiment of the invention shown in Figs. 1 to 4c, they apply equally well to the embodiment of the invention shown in Figs. 5 to 6b. Preferably, as shown in Fig. 7, the upper and lower clamping abutment surfaces **54**, **56** are sloped so that when the cutting insert is viewed in an end view the distance between them is a maximum at the first side surface **58** and a minimum at the second side surface **60**. The upper and lower clamping surfaces **28**, **32** of the upper clamping jaw **26** and the lower base jaw **30**, respectively, have matching slopes. Hence, when the cutting insert **24** is clamped in the insert pocket **42** of the cutting insert holder **22**, the upper

clamping abutment surface **54** of the cutting insert abuts the upper clamping surface **28** of the upper clamping jaw **26**, the lower clamping abutment surface **56** of the cutting insert abuts the lower clamping surface **32** of the lower base jaw **30**, the protrusion **62** on the first side **58** of the central body portion **46** of the cutting insert abuts the rear surface **45** of the recess **44** and the first side surface **58** abuts the insert holder side surface **40**.

If desired, as shown in Fig. 8, the upper and lower clamping abutment surfaces **54**, **56** have the form of V-shaped protrusions and the upper and lower clamping surfaces **28**, **32** of the upper clamping jaw **26** and the lower base jaw **30**, respectively, have the form of matching V-shaped grooves.

Further if desired, as shown in Fig. 9, the upper and lower clamping abutment surfaces **54**, **56** have the form of V-shaped grooves and the upper and lower clamping surfaces **28**, **32** of the upper clamping jaw **26** and the lower base jaw **30**, respectively, have the form of matching V-shaped protrusions.

The cutting inserts **24**, **66** described above have axial location members only on one side surface **58** of the central body portion **46**. As a result, for a given orientation of the cutting insert, one of the cutting edges **52** is an upper cutting edge, associated with the upper clamping abutment surface **54**, whilst the other cutting edge **52** is a lower cutting edge, associated with the lower clamping abutment surface **56**. Attention is now drawn to Figs. 10a to 11b. Figs. 10a and 10b show a cutting insert **72** having two protrusions **62** both constituting axial location members. One protrusion **62** is on the first side surface **58** and the other protrusion **62** is on the second side surface **60**. As seen in Fig. 10b, both cutting edges **52** are upper cutting edges, associated with the upper clamping abutment surface **54**. Similarly, Figs. 11a and 11b show a cutting insert **74** having two axial location members **70'**, **70''**, both recesses. One recess **70'** is on the first side surface **58** and the other recess **70''** is on the second side surface **60**. The dashed lines represent a hidden recess. As seen in Fig. 11b, both cutting edges **52** are upper cutting edges associated with the upper clamping abutment

surface **54**.

Although the present invention has been described to a certain degree of particularity, it should be understood that various alterations and modifications can be made without departing from the spirit or scope of the invention as hereinafter claimed. For example, the shape of the axial location member of the cutting insert and the positioning member of the cutting insert holder do not necessarily have to be square shaped, they can be round, elliptical or any other convenient shape.